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(54) Electric heater with PTC pellets for heating the interior compartment of vehicles

(57) The heater comprises a stack of radiators (10, 12, 14, 16, 18, 20) in thermal and electrical contact with PTC pellets (36) clamped between adjacent radiators. Each radiator comprises an elongated metal plate (22,

122) perforated along at list one of its longitudinal edges to form an array of fins (24, 124) which laterally project from a longitudinal strip (26, 126) and are bent in a configuration such as to enhance the thermal exchange with the environment.

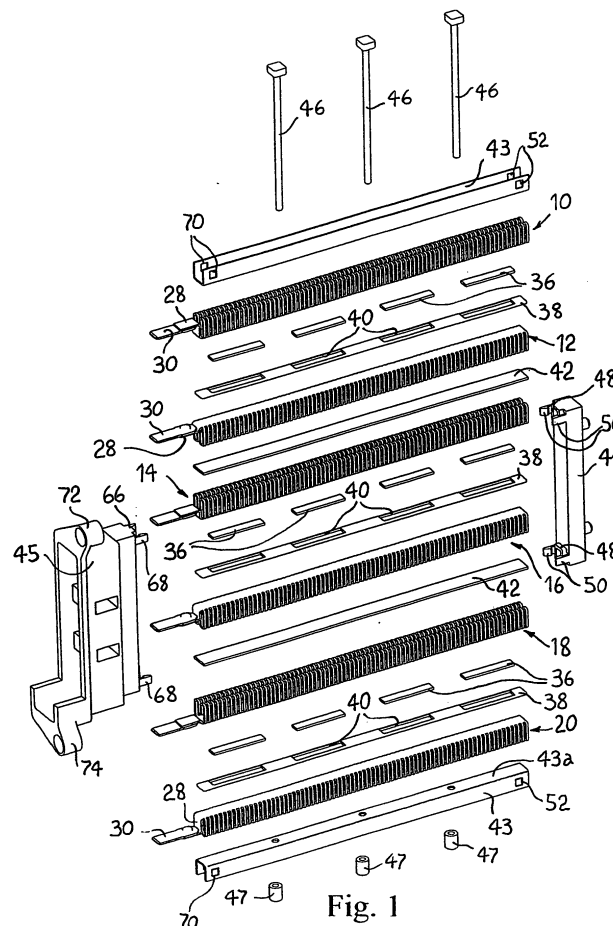


Fig. 1

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Description

[0001] The present invention relates to an electric heater with PTC pellets for heating the interior compartment of vehicles.

[0002] Car passenger compartments have been traditionally heated by heat exchangers which are located in the air path of the ventilation system and are connected to the hydraulic circuit of the engine cooling system of the vehicle. More recently, in order to immediately provide an effective heating action, even at the initial start of the car, heat exchangers are integrated with electric heaters that generally employ PTC resistors (also called thermistors) as heating sources. Such electric heaters are installed within the air conduit of the ventilation system, whereby the airflow passes through them, and they are usually activated for transient periods.

[0003] EP-A-1 574 791 describes an electric heater of the above type, in which PTC pellets are clamped between stacked radiators consisting of aluminum bars fretted with comb-shaped fins, which bars lead the electric current to the PTC pellets and are in thermal and electric contact therewith. Steel slats are arranged between the opposing combs of the the inner radiators, and operate as leaf springs in biasing the radiators against each other in a crosswise direction to provide a good contact with the sandwiched PTC pellets. A pair of brackets, which are attached to the opposite ends of the stack, maintain the inner radiators, as well as the PTC pellets and the steel slats, sandwiched between the outermost radiators.

[0004] The comb-shaped radiators are typically manufactured by transversely slicing an aluminum extrusion of a suited profile. A drawback deriving from this embodiment of the radiator is that burrs are generated during the slicing process which in operation, when the ventilation airflow passes through the radiator, can get detached from the radiator and, consequently, enter the interior compartment.

[0005] On the other hand, removing the burrs from the radiators requires an additional finishing operation which is time-consuming and increases the manufacturing costs of the heater.

[0006] Therefore, it is a main object of the invention to provide the electric heaters of the above type with improved radiators which are equally, or even more, effective than the known radiators of the above kind, and which can be manufactured by means of conventional, inexpensive known processes, which neither generate burrs nor require further finishing operations.

[0007] The above object and other advantages, which will appear from the following disclosure, are achieved by the invention with an electric heater having the features recited in claim 1, while the dependent claims state other advantageous features of the invention.

[0008] The invention will now be described in more detail with reference to a few preferred, non-exclusive embodiments, shown by way of non-limiting example in the attached drawings, wherein:

Fig. 1 is an exploded, perspective view of an electric heater according to a preferred embodiment of the invention;

Fig. 2 is a front elevation view of the electric heater of Fig. 1, as it appears when assembled;

Fig. 3 is a perspective view of a portion of a radiator belonging to the heater of Fig. 1, in a semi-finished state;

Fig. 4 is a view in transverse cross-section of the radiator of Fig. 3, in a finished state;

Fig. 5 is a perspective view of a portion of a radiator according to an alternative embodiment of the invention, in a semi-finished state;

Fig. 6 is a perspective view of the portion of radiator of Fig. 5, in a finished state;

[0009] With reference to the above Figures, an electric heater according to a preferred embodiment of the invention comprises six elongated radiators 10, 12, 14, 16, 18, 20, which are arranged one upon the other to form a stack.

[0010] Having now particular reference to Figs. 3, 4, each radiator is made from an aluminum plate 22 whose longitudinal edges are both comb-like fretted, with respective arrays of elongated, narrow fins such as 24 projecting laterally from a continuous, middle strip 26. The fins are bent at right angles at their root and are U-bent inwardly at a middle area (Fig. 4), with a configuration such as to enhance the thermal exchange with the environment. Each of the six radiators is provided with a respective electric terminal, preferably in form of a lug 28 which integrally projects from middle strip 26 and carries a swaged metal tongue 30 at its end. Lug 28 is first bent at right angles in the direction of fins 24, and then is bent outwardly in a cantilever fashion.

[0011] The six radiators are arranged in parallel pairs 10-12, 14-16, and 18-20, with the free surfaces of the middle strips 26 which face each other in each pair. Four PTC pellets 36 are clamped between the middle strips of each pair of radiators and are in relation of thermal and electrical conduction with both the radiators of the corresponding pair. A gasket 38 made of a soft synthetic material, such as a silicone resin, is also clamped between the middle strips in each pair, and has four openings such as 40 in which the PTC pellets are received. The gasket makes a tight contact with the adjacent flat surfaces of the radiators, so that the PTC pellets are protected from the airflow and, consequently, from oxidation due to humidity and pollutants. An insulating strip 42 made of a synthetic material is clamped between each pair of radiators which face each other in the direction of the fins, i.e., the pair 12-14 and the pair 16-18.

[0012] The stack of radiators, with the PTC pellets, the

gaskets and the insulating strips, are sandwiched between two rigid, C-shaped longitudinal beams 43 which are biased with their back walls 43a against the fins of the outermost radiators 10, 20, by means of three tie rods 46 having respective screw nuts 47 tightened at their ends, preferably with a control upon the driving torque applied to the nuts, in order to maintain the unit assembled with a correct pressure upon the PTC pellets.

[0013] Two brackets 44, 45 are anchored to the opposite ends of the stack of radiators. Brackets 44, 45 are preferably molded of a rigid, synthetic material. Bracket 44 is provided with projections 48 which engage the ends of longitudinal beams 43, as well as with lateral hook-like arms 50 which restrainedly engage corresponding lateral slots 52 in longitudinal beams 43 with a snap action.

[0014] Bracket 45 is similar to bracket 44 in that it has centering projections 66 which engage the ends of longitudinal beams 43, and lateral hook-like arms 68 which restrainedly engage corresponding slots 70 in longitudinal beams 43. Bracket 45 is also provided with eyelets 72, 74 for the installation of the heater in the ventilation system, and with openings (not shown) in which the electric terminals are inserted for their connection to external circuitry (not shown).

[0015] The radiators may be manufactured in a conventional way by shearing an aluminum plate with a cutting tool suited to form a comb-like profile. As the person skilled in the art will immediately understand, this shearing operation upon a thin aluminum plate produces a clean cut without formation of burrs, so that further finishing operations are not required. A further advantage of the above radiators is that they have a wide thermal exchange surface with a reduced volume of material, with consequent improved efficiency.

[0016] Finally, a simple and quick assembly operation can be set up, as a person skilled in the art will readily appreciate. The stack comprising the longitudinal beams, the radiators and the PTC pellets, may be formed in a jig by merely placing the several parts one above the other, and then the heater is completed by tightening the tie rods and by approaching the brackets to the ends of the stack, until hook-like arms 50, 68 engage the slots in longitudinal beams 43.

[0017] An alternative embodiment of the invention is shown in Figs. 5, 6, wherein each radiator is made from an aluminum plate 122 having both its longitudinal edges perforated with arrays of L-shaped cuts which are open to the lateral edge of the plate and have one side of the L arranged at right angles to the longitudinal dimension of the plate, whereby arrays of fins such as 124 are defined which laterally project from a continuous, middle strip 126. Each fin 124 is bent at right angles along a transverse line T passing through the inner end of the L-shaped cuts, and is also bent at right angles at its root (Fig. 6).

[0018] A few preferred embodiments of the invention have been described herein, but many changes may be made by the person skilled in the art within the scope of

the inventive concept. For example, the fins on the radiators could be formed only along one side of the plate.

5 Claims

1. An electric heater for vehicle ventilation systems, comprising a stack of radiators (10, 12, 14, 16, 18, 20) in thermal and electrical contact with PTC pellets (36) clamped between adjacent radiators, **characterized in that** each of said radiators comprises an elongated metal plate (22, 122) perforated along at list one of its longitudinal edges to form an array of fins (24, 124) which laterally project from a longitudinal strip (26, 126) and are bent in a configuration such as to enhance the thermal exchange with the environment.
2. The heater of claim 1, **characterized in that** said fins (24, 124) are substantially bent at their root at right angles to said strip (26, 126).
3. The heater of claim 2, **characterized in that** said fins (24) have an elongated, narrow profile and are U-bent inwardly in a middle area.
4. The heater of claim 2, **characterized in that** said elongated metal plate (122) is perforated with an array of L-shaped cuts that are open to the corresponding lateral edge of the plate (122) to form an array of fins (124) which laterally project from a strip (126), each fin (124) being bent at right angles along a line (T) transverse to the strip (26).
5. The heater of claim 1, **characterized in that** said plate is perforated along both its longitudinal edges.
6. The heater of any of claims 1 to 5, **characterized in that** said radiators are arranged in parallel pairs (10-12, 14-16, 18-20), with said PTC pellets (36) clamped between strips (26) facing each other in each pair.
7. The heater of any of claims 1 to 6, **characterized in that** said radiators, with the PTC pellets arranged therebetween, are sandwiched between two rigid longitudinal beams (43) biased against the outermost radiators (10, 12) by means of tie rods (46).

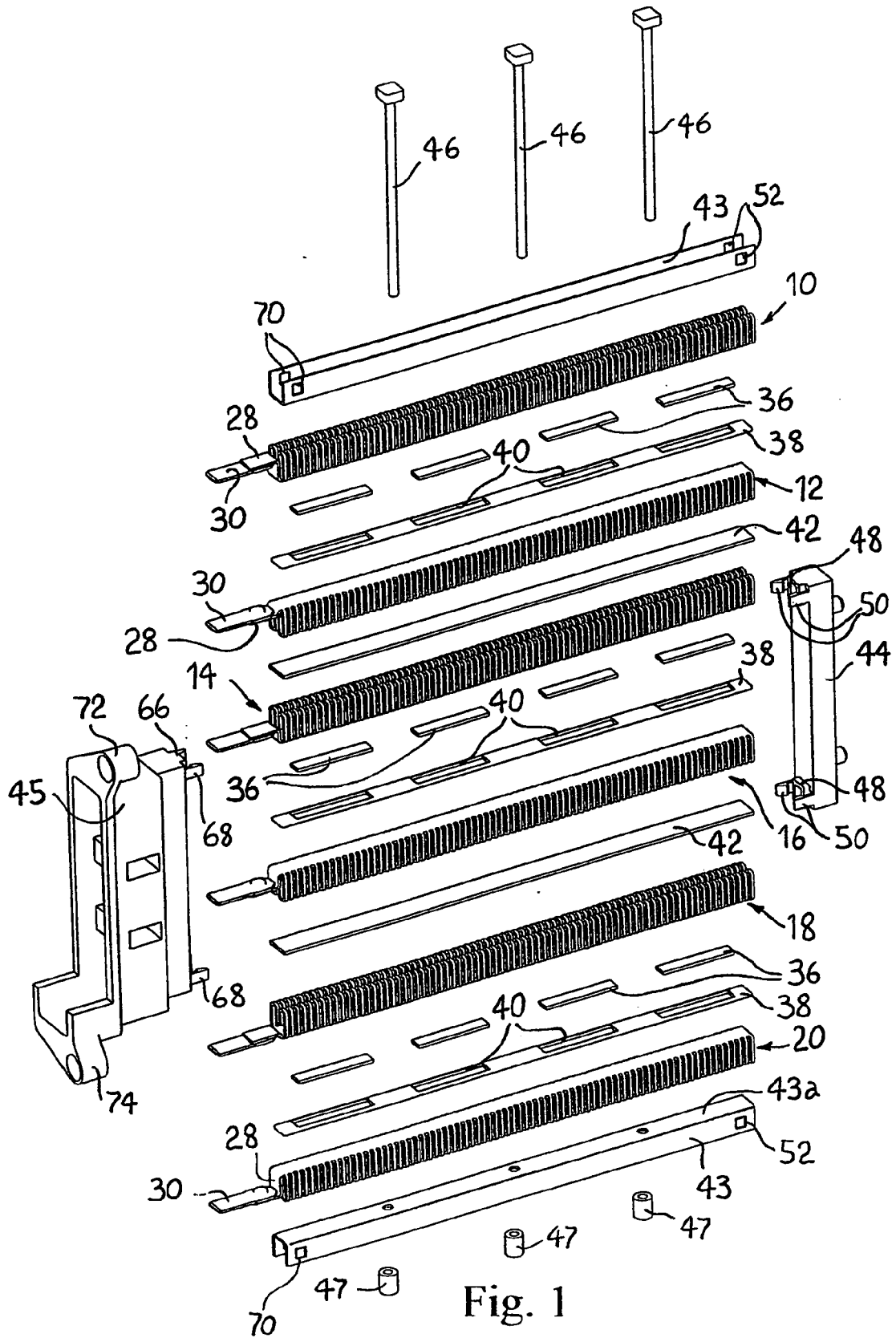


Fig. 1

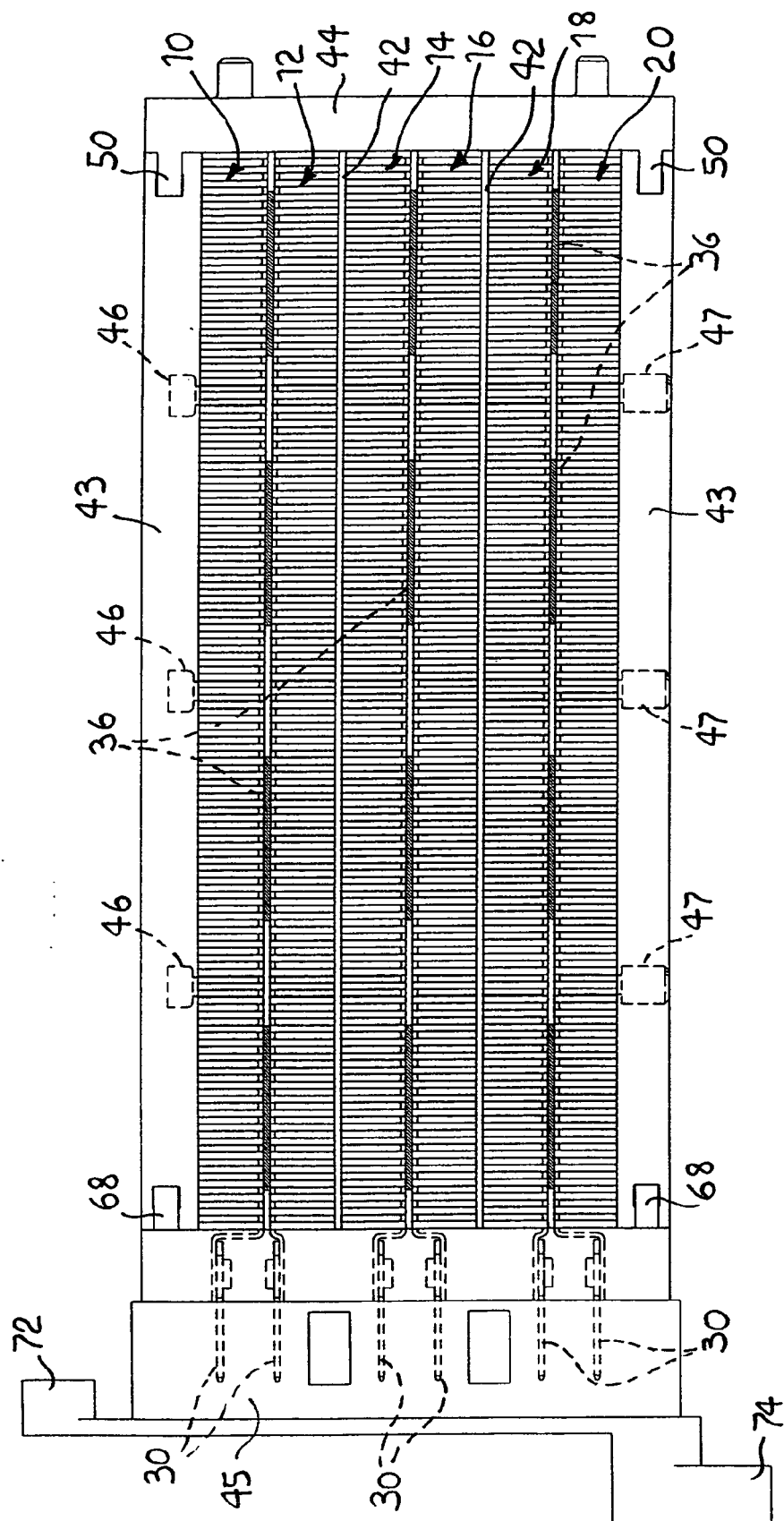
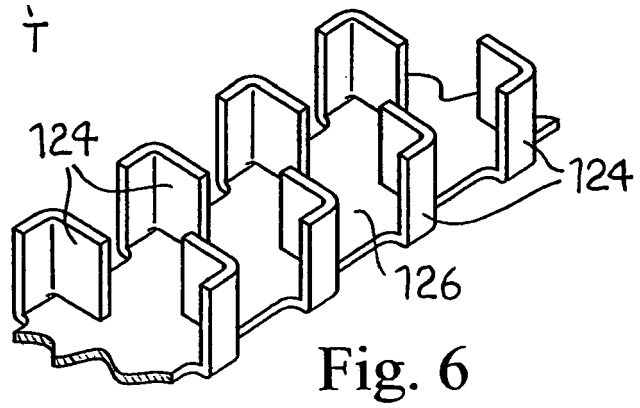
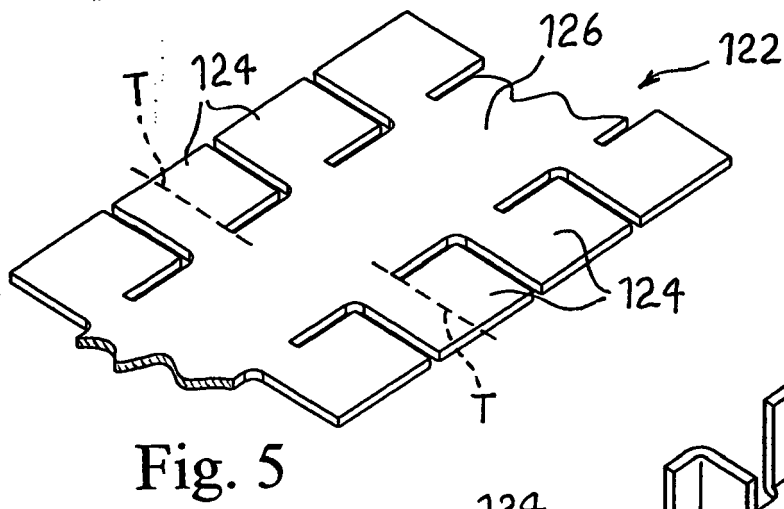
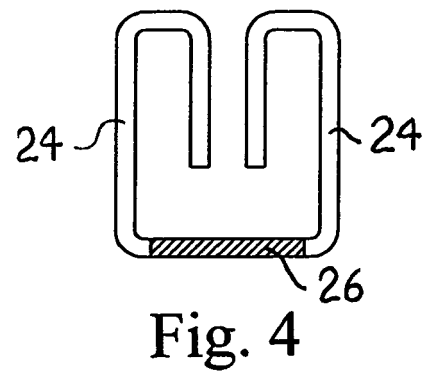
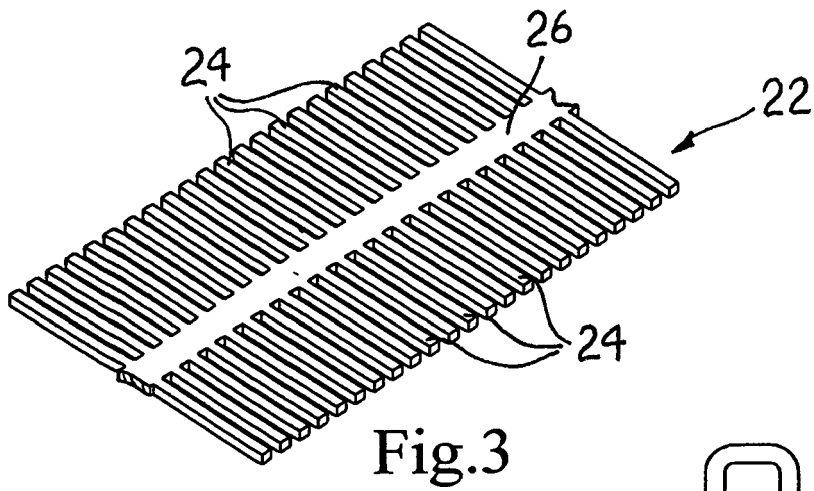


Fig. 2





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 42 5268

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 September 2006	Examiner Arndt, M
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 06 42 5268

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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